

2.0 SITE BACKGROUND

This location summarizes the Site's setting and history, including a summary of the RI/FS and remedial design/remedial action (RD/RA).

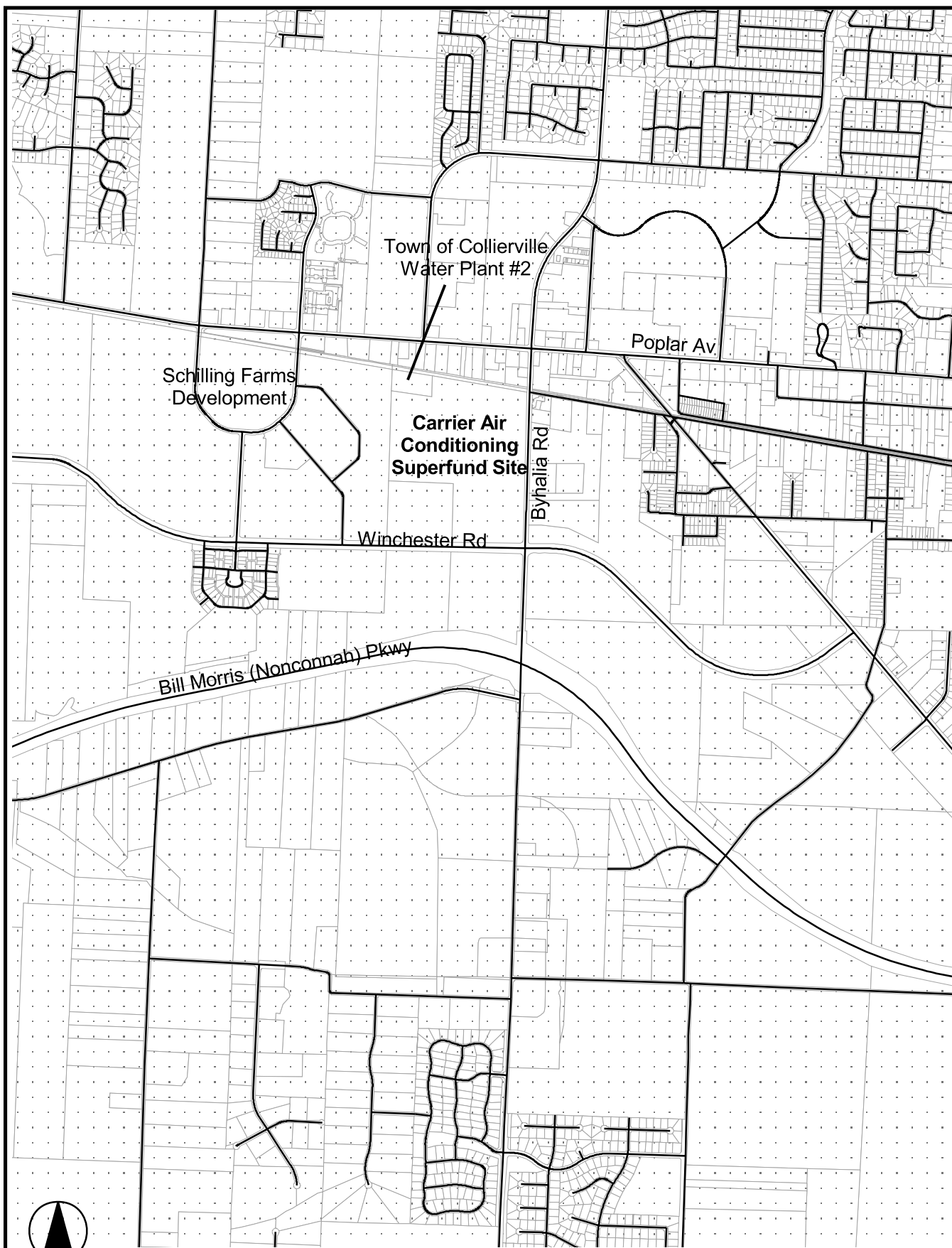
2.1 Physical Characteristics

The Carrier Site is located on the western side of the Town of Collierville, Shelby County, Tennessee (population approximately 30,000). The site, shown in Figure 2-1, is located near the intersection of U.S. Highway 72 and Byhalia Road with the nearest residential area being approximately 100 feet North of the Site boundary adjacent to the Collierville municipal well field.

The Site is in the Gulf Coastal Plain, which is a major physiographic subdivision distinguished by gently rolling topography and a characteristically thick layer of loess deposited during Pleistocene glaciation. Because of the gently rolling topography, the site has been graded and filled in various locations in order to change drainage patterns and adapt the land for manufacturing use.

Anomalous areas of loess deposition are associated with alluvial plains of Mississippi River tributaries that cross the area. These rivers include the Wolf River, the Loosahatchie River and Nonconnah Creek. Nonconnah Creek runs through the southern site boundary.

The nature of the Site is such that avian or terrestrial wildlife would not be drawn to the site. Any wildlife near the site is expected to be minimal, given the amount of development in the area. Since the impacted areas are within the working area of the manufacturing facility, wildlife is not expected to be present in impacted areas currently undergoing remedial actions.



2000 0 2000 Feet

File: //gissafe/projects/carrier/collierville.apr



Figure 2-1
Site Location Map
Carrier Collierville Site
Collierville, Tennessee

2.2 Land and Resource Use

A site map is shown in Figure 2-2.

Prior to 1967, the Site consisted of maintained vegetation (i.e., grasses and trees). In 1967 the Town of Collierville purchased the property, constructed industrial buildings, and purchased industrial equipment for the Site. In March 1967, the property, buildings, and equipment were leased to Carrier Air Conditioning Corporation. Later the same year, Carrier began manufacturing residential heating and air conditioning units at the Site.

Also in 1967, the Town of Collierville installed a well field for potable water on the northwest corner of the Site. The operation, consisting of two extraction wells, a treatment plant, and a storage tank, is identified as Water Plant #2. Currently, under frequent monitoring, the wells provide up to 1.4 million gallons per day (MGD) of potable water to the Town of Collierville.

In 1987, Carrier purchased the facility from the Town of Collierville, excluding the northwest parcel on which Water Plant #2 is located.

With the current strict zoning, the long term, future use of the Site would be for continued industrial use. The Site is an operating facility and will continue to be so for the foreseeable future.

With the exception of Nonconnah Creek, surface waters do not exist on Site or adjacent to the Site. Town and county ordinances restrict the use of the shallow water bearing zone and the Memphis Sand aquifer. The Memphis Sand aquifer is the primary drinking water source and is regulated by the Memphis Shelby County and the Town of Collierville to prohibit installation of wells in the Memphis Sand aquifer or shallow aquifer without a permit. Therefore, shallow groundwater is not currently used for domestic purposes in the immediate area. The nearest municipal well in the Memphis Sand aquifer, is located adjacent to the northwest corner of the Site.

Figure 2-2 Site Map

Current groundwater pathways exist for the local residents supplied by the Collierville municipal water supply system. Actual exposure to groundwater contaminants (through the municipal system) is minimized (or eliminated) by engineering controls (i.e., air stripping of municipal well water prior to distribution).

2.3 History of Contamination

In the process of assembling air conditioning units, aluminum sheeting is stamped and assembled with copper tubing to form air heat exchangers. Stamping and forming oils and dirt are removed from these parts prior to final assembly. Until about 1986, trichloroethylene (TCE) was the primary solvent used to degrease and clean these parts.

Contamination Sources

In 1979 and 1985, TCE releases occurred from solvent storage systems to an area just south of the main manufacturing building. The approximate release areas are shown on Figure 2-2. The 1979 release, which occurred from a vent degreaser pipe, was estimated to be several thousand gallons. In 1985, approximately 500 gallons of TCE was released from a pipe associated with an aboveground storage tank in the same vicinity. Soil removals were performed by Carrier following both spills.

In the rear of the facility, a wastewater lagoon operated by the plant from 1972 to 1979 apparently received TCE- and zinc-contaminated waste sometime during its seven-year operational period that resulted in contamination of lagoon sediment. Impacted sediment was removed from the lagoon prior to closure, and in 1989 a soil and groundwater treatment system (the NRS) was installed.

As a result of the 1985 spill, monitoring wells were installed at the facility to monitor groundwater. Since 1985, the Tennessee Department of Environmental Conservation (TDEC)¹ required groundwater monitoring on a regular basis. In 1986, low levels of TCE were

¹ This agency was formerly known as Tennessee Department of Health and the Environment (TDHE).

detected in the groundwater from the two extraction wells in the Town of Collierville's Water Plant #2. No TCE was found in treated water (i.e., water just before it enters the Town's distribution system) from the two extraction wells. In 1990, air stripper treatment systems (packed aeration towers) were installed by Carrier at Water Plant #2 to provide additional assurance that the Town's drinking water supply would meet Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs).

In 1987 and 1988, under an agreement with TDEC, Carrier conducted an extensive Site investigation. Sampling indicated measurable amounts of TCE in the soils and smaller amounts in the groundwater at the Site. The Site investigation also confirmed the earlier finding of low TCE concentrations in the groundwater from Water Plant 2.

The Site was proposed for listing on the federal National Priorities List (NPL) in 1988. Carrier and USEPA signed a consent decree in 1989 to perform the RI/FS, and the Site was listed on the NPL in 1990.

Remedial Investigation

As a result of the spills, the USEPA ordered that an RI/FS be conducted to determine the extent of contamination from TCE source areas to groundwater, specifically shallow groundwater. The Remedial Investigation (RI) was performed in multiple phases during 1990 and 1991, with draft RIs submitted throughout 1991 and a final document (including a Baseline Risk Assessment (BRA) produced in 1992.

Previous investigations at the Site initiated by TDEC had resulted in the installation of fifty-five soil borings. Eighteen of these borings were completed as monitoring wells; ten in the fluvial terrace deposits above the Jackson clay and eight within the Memphis Sands aquifer beneath the Jackson clay layer. In order to complete the determination of extent of contamination, a series of thirty-two additional borings were augered on Site during the RI. Contaminants found left on Site were TCE, cis-1,2-dichloroethylene (DCE), trans-1,2-dichloroethylene, tetrachloroethene (PCE), vinyl chloride, and zinc.

The RI verified the contaminants of concern at the Site, identified both the MPA and the former lagoon as primary source areas, and calculated soil cleanup goals protective of groundwater. The BRA (detailed in Section 3) concluded that there were no risks to onSite workers due to ingestion or direct contact of exposed, contaminated soil.

Hydrogeologic Setting

The RI also included an assessment of complex hydrogeologic setting of the Site. A shallow, non-potable aquifer (found in fluvial terrace deposits), usually only a few feet thick, was found across the Site. The RI postulated that this zone is primarily perched groundwater. The Jackson clay, which has since been referred to as the “Jackson/Upper Claiborne formation,” underlies fluvial deposits. Silts and clays typical of the Jackson/Upper Claiborne sequence were not encountered in borings completed south and east of the Carrier facility. Rather, surficial loess and fluvial deposits were deposited directly over the primary drinking water aquifer in the Memphis area, the Memphis Sand. These data indicated that the perched groundwater zone encountered beneath the MPA was hydraulically connected with the Memphis Sand southeast and east of the Carrier facility. Groundwater in the Memphis Sand flows from the southeast, beneath the Carrier facility, and then to the northwest, to Water Plant #2.

Contaminants exceeding maximum contaminant levels (MCLs) were quantified in both shallow (fluvial deposit) and deep (Memphis Sand) wells during the RI. The RI postulated that contaminants had migrated from source areas along the top of clay “downslope” to the southeast, where the absence of the Jackson/Upper Claiborne unit allowed direct infiltration of contaminants into the Memphis Sand. Aquifer testing during the RI indicated that municipal pumping at Water Plant #2 controls groundwater flow beneath the Site, and confirmed that there was indeed hydraulic connection between the two units where clay was absent.

The BRA for groundwater contamination resulted in risk ranges exceeding 1E-04. Given the proximity to Water Plant #2 and the presence of Site contaminants in the municipal water supply, the BRA was evaluated using a residential drinking water scenario. However, treatment of groundwater prior to entry to the Town’s drinking water distribution system established at Water Plant #2 during 1990 was noted to eliminate this risk and reduce contaminant concentrations to below SDWA MCLs.

Carrier performed an FS for the Site in 1992. The FS discussed six remedial alternatives for the CAC Site. The need for remedial actions was identified in three areas: the former lagoon area, the MPA, and the Memphis Sand Aquifer. The document compared various remedies and treatment technologies for each of the three areas.

USEPA issued the final ROD for the Site in September 1992, which documented the selected remedy for the CAC Site. The remedy consisted of:

- Institutional controls limiting future land use at the Site to industrial, and limiting water well construction in the area which may adversely impact containment at Water Plant #2.
- Continuation of the SVE system at the NRS (installed in the former lagoon area).
- Installation of an SVE system in the MPA.
- Containment of the groundwater plume using Water Plant #2 wells, with ongoing treatment of extracted groundwater via air stripping.

Remedial design activities began at the Site in 1993.

2.4 Site Chronology

Table 2-1 is a chronology of events related to the Site investigation at the CAC Site.

**Table 2-1
Chronology of Events**

Date	Event	Additional Information
1967	Town of Collierville purchases the property, constructs industrial buildings, and purchases industrial equipment for the Site. Carrier Air Conditioning Corporation leases the property, buildings and equipment for use as a manufacturing facility. Town of Collierville installs two extraction wells (Water Plant 2) on the northwest corner of the Site to supply drinking water to residents.	
1972	Carrier installs wastewater lagoon (surface impoundment) north of plant.	Sometime between 1972 to 1979 the wastewater lagoon received TCE- and zinc-contaminated waste, resulting in contamination of lagoon sediment.
1979	Carrier takes wastewater lagoon out of service. Spill of an estimated several thousand gallons occurs at a vent degreaser pipe just south of the main manufacturing building.	Carrier removed asphalt pavement and underlying soil from the parking area in areas affected by spill. Carrier removes approximately one foot of contaminated sludge from the base of the lagoon for offSite disposal.
1981	Wastewater lagoon is closed.	
1982	Lease amended to exclude northwest portion of property where Town's well are located.	
1985	Spill of approximately 500 allons occurs from TCE aboveground storage tank south of main manufacturing building. Carrier installed monitoring wells at the Site to monitor groundwater.	Tank, associated piping, and up to 15 feet of contaminated soil was excavated and shipped offSite for disposal by Carrier. Groundwater monitoring at the Site continued on a regular basis.
1986	TDEC performed site assessment.	Low levels of TCE detected in the groundwater from the two extraction wells in the Town of Collierville's Water Plant 2. No TCE was found in treated water (i.e., water just before it enters the Town's distribution system) from the two extraction wells. As a result, under frequent monitoring, operation continued.
1987	On December 14, Carrier purchased all the property in the lease from the Town of Collierville. Site is placed on TDEC's List of Hazardous Substances Sites. Carrier initiates an extensive, voluntary site investigation under an agreement with TDEC through 1988.	Carrier is still the current land owner. Sampling indicated measurable concentrations of TCE in soil and lower concentrations in groundwater. Sampling confirmed TDEC finding of low TCE concentrations in Water Plant 2 groundwater.
1988	Voluntary Site investigation report is released to TDEC and EPA In June, the Site was proposed for inclusion on EPA's National Priorities List (NPL).	
1989	In September, Carrier and EPA sign CERCLA Consent Order. Carrier installs a groundwater removal and treatment system and soil vapor extraction (SVE) system in the former wastewater lagoon (the North Remediation System, or NRS).	Under this order, Carrier agrees to perform RI/FS to determine the type and extent of contamination at the Site and identify remedial action alternatives.
16		
1990	Placement of Site on NPL is finalized. Carrier commences remedial investigation (RI).	

	Draft RI report submitted to EPA	
	Carrier installs air stripper treatment systems (packed aeration towers) at Water Plant 2 to provide additional assurance of the removal of trace amounts of TCE and its degradation products from the Town's raw water supply.	Water Plant 2 remains in continuous service, providing up to 1.4 MGD of potable water to the Town of Collierville.
	Design, construction, and operation of system was coordinated with and approved by State, Town, and EPA agencies.	
1992	The RI/FS Reports and Proposed Plan for the Site are finalized and released to the public	<p>The RI outlined investigation findings and the FS identified the need for remediation in three areas:</p> <ul style="list-style-type: none"> (1) former lagoon area (to address impact of former discharges to lagoon) (2) main plume area or MPA (to address impacts from the 1979 and 1985 TCE spills) (3) Memphis Sand aquifer (to contain on-site groundwater plume that had been impacted as a result of soil contamination). <p>Six remedial alternatives for the Site were also presented.</p>
1992 (Cont'd)	<p>EPA Regional Administrator Greer C. Tidwell signs the Record of Decision (ROD) which documents the selected remedy for the Site.</p> <p>Supplemental aquifer testing using the Town of Collierville's wellfield to support groundwater remedy design and to gauge the wellfield's adequacy to contain the contaminated Memphis Sand plume.</p>	<p>Site remedy consisted of:</p> <ul style="list-style-type: none"> • Institutional controls limiting future land use at the site to industrial, and limiting water well construction in the area (restrict installation of wells which may adversely impact containment at Water Plant #2). • Continuation of the SVE system (NRS) in the former lagoon area. • Installation of an SVE system in the MPA to treat contamination that resulted from the 1979 and 1985 spills. • Containment of the groundwater plume using the municipal well field at Water Plant #2, with ongoing treatment of extracted groundwater via air stripping.
1993	EPA issues a Unilateral Administrative Order and Scope of Work for completion of remedial action tasks.	
1994	MPA SVE Project Design and Groundwater Remedy Design documents were submitted.	
	Construction on the MPA SVE system was initiated.	The system was installed to treat contamination that resulted from the 1979 and 1985 spills.
	Installation of downgradient/point-of-compliance monitoring wells MW-60 and MW-62 occurred.	
1995	MPA SVE system construction was completed with the system beginning operation during March 1995. Final inspection of the MPA SVE system was performed on June 1, 1995.	Recurring problems with the regenerative blower used for the MPA system necessitated system shutdown in December followed by replacement with a positive displacement blower, which occurred in February 1996. Otherwise, treatment system has been operating continuously since installation.
1996	Modifications to the MPA SVE system and testing of the new equipment were performed in February 1996, immediately followed by system re-start. Supplemental modeling of the degree of containment provided by Water Plant 2 was performed in July and August 1996, during a month-long shut down of the Town wells for maintenance.	

	Soil borings were completed at the NRS to assess effectiveness of the NRS SVE system in December.	Improvements that were determined as a result of the assessment were addressed in 1997.	<i>Five-Year Review of the Site August 24, 2000</i>
1997	Based on the 1996 sampling event, modifications were made to NRS operation: deep wells were opened to act as passive vents while vapor extraction was continued in shallow wells. During summer months, ambient air was also introduced into the shallow well manifold to moderate temperatures in the blower and minimize operational problems. Carrier started abandonment of 55 monitoring and pilot study wells installed during the RI or RD investigation.		
1998	Abandonment of wells completed during the first quarter. All wells were closed in accordance with Shelby County Health Department regulations.	Appendix A contains tables with list of wells that have been closed and wells that have been left open. A figure illustrating the location of open wells is also included in Appendix A.	
1998 (Cont'd)	NRS blower failure, replacement with a positive displacement blower capable of generating higher vacuum. TDOT begins expansion of adjacent roadway; monitoring well MW-16 is in the construction area. Request to abandon MW-16 due to TDOT construction; subsequent abandonment of MW-16		
2000	CAC Site Five-Year Review.		